CALS TEST NETWORK

CTN Report
93-005

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

21 December 1992

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

19960822 212

Prepared for the CALS Test Network
Air Force CALS Program Office
HQ Air Force Materiel Command
HQ AFMC/ENC
4027 Col Glenn Hwy Suite 200
Dayton OH 45431-1601

DTIC QUALITY INSPECTED 3

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

21 December 1992

FINAL

Prepared by:

Department of the Army
JCALS

DTIC QUALITY INSPECTED 3

Joint
Computer-aided Acquisition
and Logistic Support (JCALS)

CALS Technology Center (CTC)

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

CONTRACT NO.: DAAB07-89-D-A047
TASK NO.: 92-012

21 December 1992

FINAL

Prepared for:

Department of the Army
PM JCALS

Prepared By:

Accurate Information Systems, Inc.
Meridian Center 1
2 Industrial Way
Eatontown, New Jersey 07724

The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless designated by other documentation.

Contents

LIST OF TABLES

EXECUTIVE SUMMARY

This report provides the first results of laboratory testing of the Computer-Assisted Data Acceptance tools for the acceptance of Contractor-provided CALS raster type 1 data. The testing to date has only been performed with legacy data obtained from the DSREDS and EDCARS sites that was converted to meet the CALS standards. It has been difficult to obtain data. Thanks to the efforts of the CALS Test Network Office (CTNO), Lawrence Livermore Laboratories, and the Communication Electronics Command (CECOM) Concurrent Engineering Directorate three set of data were obtained.

Each of the three sets of contractor data were loaded, evaluated by the CADA tools and the results analyzed as reported herein. A great deal of difficulty was encountered in applying the CADA tools to the IBM and Hughes data since it was not of high quality and of a format that had not been previously analyzed. The data from IBM and Hughes consisted mainly of technical illustrations with no borders. A high rejection rate was obtained on these images because the current CADA algorithms work best with engineering drawings that conform to ANSI standards and not on technical illustrations. The ID recognition portion was not tested on these images because they have no borders.

The data obtained from CECOM was from a contract with Magnavox and, of the three sets, was the most representative of the data expected to be received by the DSREDS, EDCARS, and JEDMICS repositories. About 90% of these images, consisting of engineering drawings, parts lists, and associated lists were accepted by the CADA image analysis software. However, a large percentage of these images (about 75%) were rejected in the ID recognition portion due to different reasons documented in this report.

The results indicate that further work is needed to improve the accuracy of the CADA tools. For image quality analysis, it is recommended that additional work be performed with the Magnavox data and with the local CECOM QA inspectors in establishing general, objective criteria for image acceptance and tuning the CADA software to match with those criteria. A test plan has been prepared to implement this next step in the use of the CADA tools to accept contractor data.

For ID recognition, improvement is required in all the three stages of pre-processing, recognition, and post-processing. Work is underway in each of these areas and a test report will be submitted showing the results of the laboratory testing of the Magnavox contractor data as it compares to manual testing performed by CECOM DSREDS QA personnel.

Disclaimer

The use of trade names in this document or discussion of a particular product does not constitute an endorsement or approval of the use of such commercial equipment. This document may not be cited for the purpose of advertisement.

1 INTRODUCTION

This report provides the first documented results of the laboratory tests of Computer-aided Acquisition Logistic Support (CALS) Contractor-provided raster data and the Computer-Assisted Data Acceptance (CADA) software tools. Testing was performed on a Sun platform. Field operational testing, within the Air Force and Army, of contractor provided CALS raster data via use of the CADA tools, on specified platforms, will be the next step in the CADA tool development testing process.

1.1 Background

The Army has been designated by the Department of Defense (DoD) CALS as the lead Service to develop and test procedures for the acceptance of CALS digital data. The CALS Technology Center (CTC) located at Ft. Monmouth, NJ, is the designated test bed for the Army Service. Program Manager (PM) Joint CALS (JCALS), under the direction of the CALS Test Network Office (CTNO), has developed CADA procedures for accepting engineering data in CALS raster format. The CADA procedures depend on tools and techniques that can automate the analysis of the digital data. The two key areas identified for automating the acceptance of CALS digital data are the quality of the Image data and the accuracy and quality of the Identification Data (ID).

Previous reports have documented the testing of the CADA tools via use of laboratory generated test data and a representative sample of some 6000 images obtained from the Army DSREDS and Air Force EDCARS repositories. Most of this testing was to evaluate the different image algorithms individually and in various combinations. A subset of image algorithms were integrated and through-put performance testing was conducted on a Sun platform and a PC platform. The verification of the ID inside the CALS header with the identification within the image area of the engineering drawing was then tested with pre-processing software and with OCR/ICR engines for both accuracy and speed. These reports entitled *Testing Advanced Techniques*, dated 12 July 1991 and *CADA Performance Test Report*, dated 9 November 1992 are available from the CALS Test Network Office (CTNO), Dayton OH or the PM JCALS office, Ft. Monmouth, NJ.

1.2 Purpose

This report presents the Laboratory Acceptance Testing of Contractor-provided CALS data via the use of automated software (CADA) tools. The main objectives of the tests were:

1. perform and document manual, 100% quality assurance (QA), acceptance testing of Contractor-provided CALS data at the PM JCALS, CALS Technology Center (CTC) by CADA personnel;

2. perform automated CADA laboratory acceptance tests of the data that had been

evaluated manually by CTC CADA personnel;

3. provide a comparison of the manual and automated (CADA) test results; and

4. provide a summary of the analysis with recommendations.

1.3 Scope

The scope of testing involves evaluating the manual and automated acceptance of Contractor-provided CALS raster data within the CTC laboratory. The extent of the tests included:

1. obtaining the contractor data from the CECOM Concurrent Engineering Directorate and coordinating the manual tests within the CTC by CADA personnel;

2. obtaining additional contractor data from the CTN Lawrence Livermore Laboratories and performing manual and automated (CADA) tests within the PM JCALS, CALS Technology Center (CTC) laboratory environment;

3. performing the tests and comparing the results; and

4. preparing a report of the testing results.

2 TESTING OUTLINE

2.1 Location

Laboratory Contractor data testing, using CADA tools, analysis of the test results, and preparation of this test report was performed at the PM JCALS CALS Technology Center (CTC) at Fort Monmouth, New Jersey, for the CALS Test Network Office.

2.2 Test Plans

The Test Plan which is located in Appendix B of this document, was prepared to facilitate concurrent testing of a common set of contractor data in a laboratory environment and by users in a field environment. Difficulty in loading the CALS data at the field DSREDS site delayed the field testing so the Test Plan was changed to conduct the tests, at this time, in the CTC laboratory environment only.

The implementation of the Test Plan was changed to include only the PM JCALS CTC participation defined in Section 4.2 of the Test Plan and manual QA by CADA personnel. This effort is based on the results of these tests.

3 LABORATORY CONTRACTOR DATA TEST PARAMETERS

Dates:

Actual Testing: November and December 1992

Evaluators:

PM JCALS Technology Center Personnel
PM JCALS, SFAE-PS-CAL-T
Ft. Monmouth, New Jersey

ACCURATE Information Systems, Inc. Personnel
Meridian Center One,
Two Industrial Way,
Eatontown, New Jersey 07724

Data Types:

MIL-R-28002 Raster Type 1 binary data on CALS formatted Magnetic Tape media from the following contractors:

Hughes
IBM
Magnavox

System Description:

PM JCALS CADA Platform Hardware:	Sun IPX; 48MB RAM, 1.3GB H. Disk, HP Tape Drive and a PC Gateway 2000, 50MHZ - 486 DX2 with; 16MB RAM, 340MB SCSI Hard Disk
PM JCALS CADA Platform Software:	SunOS 4.1.1, Sun NewsServer -X11R4 compliant MOTIF Window Manager 1.1 and on the PC: SCO UNIX Open Desktop 2.0, X11R4 Server, MOTIF Window Manager 1.1
PM JCALS CADA Software:	CADA Tools Ver. 0.5 with: XVT Portability Toolkit Ver 3.0 UniSoft's PC Imaging Library Ver. 5.1, CTN's Tape Tool Ver 1.2.8 NestorReader PC Ver. 1.2

4 LABORATORY CONTRACTOR DATA TEST PROCEDURE SUMMARY

The availability of CALS Contractor data has been a problem. A number of Government agencies have cooperated since June of 1992 in an attempt to obtain data. We were able to obtain three magnetic tapes through the efforts of the CALS Test Network Office (CTNO), the Lawrence Livermore National Laboratory, and the Army CECOM Concurrent Engineering Directorate at Ft. Monmouth, New Jersey. The Contractor data sources and the approach in conducting the tests within the CTC of PM JCALS are described herein.

4.1 Test Data Sources

Table 1 provides a summary of the source of the CALS contractor data and the organizations responsible for obtaining the data.

Table 1. Test Data Sources

Media / Qty	Contractor	Responsible Organizations
Mag. Tape / 1	Hughes	Lawrence Livermore Laboratories
Mag. Tape / 1	IBM	Lawrence Livermore Laboratories
Mag. Tape / 1	Magnavox	Army CECOM Concurrent Engineering Directorate

4.2 Testing Approach

The approach taken in testing the three sets of contractor data was to load the data onto the Sun platform, conduct CADA evaluations for image quality and identification data (ID) accuracy and then analyze the results. Three sets of image evaluation parameters were applied: high quality, medium quality, and low quality, and the results recorded. For each set of image parameters both image and ID evaluations were performed. The ID evaluations were only performed for those images that were accepted by image evaluations. The image and ID results were then analyzed and the report prepared.

4.2.1 Acquire Contractor Data

Three sets of contractor data were used in evaluating the CADA tools. Two sets were obtained by Lawrence Livermore Laboratories from Hughes and IBM. A third set was provided by the CECOM Concurrent Engineering Directorate that was prepared by Magnavox.

The Hughes data contains 217 images that consist of mostly Notices of Request (NORs) and Engineering Change Requests (ECRs). There are no title blocks or borders for most of the images, and the quality is poor.

The IBM tape consists of 71 images that are technical illustrations with no borders and no identification data. Most of the images are readable but have characteristics different from engineering quality data, causing a substantial number of rejects.

The Magnavox tape contains 228 images consisting of engineering drawings, parts lists and data lists. Most of these images meet the specifications for format; however, many of the images are light and have faded areas.

4.2.2 Load and Evaluate CALS Media Format

The Contractor-provided CALS magnetic tapes were loaded onto the CADA platform and the CALS format was validated. Some problems were found initially, for example, the tapes provided by Magnavox contained header record formats that did not conform to the MIL-D-1840A standard. Magnavox corrected the problem and provided new CALS magnetic tapes.

4.2.3 Conduct CADA Image Testing

All the contractor tapes were unloaded using the CADA tool. The tools were then used to evaluate the accuracy of ID information and image qualities. Then the images were visually inspected to identify false rejection and false acceptance and the results were analyzed.

4.2.3.1 IBM Tests

There are three documents on the IBM tape, each consisting of an SGML set and a set of technical illustrations. Only one of those three sets of technical illustrations was tested. Due to decompression errors, the other two sets could not be evaluated. the CADA image evaluation tools were utilized to check the image quality. Because these technical illustrations contained no borders and no identification data, ID recognition was not performed.

4.2.3.2 Hughes Tests

The Hughes tape consists of 20 sets of images; most of them are NORs and ECRs, and there are no engineering drawings. Image evaluation was performed for all 20 sets, for a total of 217 image files. The majority have no title block and no border, therefore, ID recognition was not used on these sets.

4.2.3.3 Magnavox Tests

- There are 50 sets of engineering drawings and accompanying documents on the Magnavox tape. The engineering drawing sizes vary from A to E and the accompanying documents

contain Data List, Part List and Associate Lists. All of the 228 image files were tested using CADA image evaluation and ID recognition tools. Three sets of parameters were used to evaluate different levels of image quality (high, medium and low quality).

After evaluating the data using CADA tools, all data were visually inspected to verify the test results.

4.2.4 Conduct CADA ID Testing

The ID recognition portion of CADA verifies that the ID data[1] within the CALS 1840 header matches the corresponding data appearing in the title block of the engineering drawing. The software which performs this is contained within three distinct modules: pre-processing, recognition, and post-processing.

The pre-processing stage consists of locating the border[2] within the image, cropping the title block and revision block portion of the image as regions of interest (ROI), extracting the components within the ROIs and grouping these components into strings.

These strings are then input to the recognition engine, which returns the recognized ASCII results along with their confidence values.

The recognition results are then processed by the post-processing unit consisting of string matching algorithms. These algorithms consider confusion classes[3] and string distances in matching the CALS header with the recognized information. An image accept or reject decision is returned based on these comparisons.

4.3 Analyze CADA Results

4.3.1 Image Analysis

CADA image analysis techniques were applied on the three sets of contractor data with the following parameter settings.

Run length ratio <= 14
Approximate black orphan ratio <= 0.024
Approximate white orphan ratio <= 0.430
Peak tile noise <=165

---

[1] ID data consists of the following fields: image size, drawing number, cage code, sheet number, and revision letter.

[2] The border in an engineering drawing is used as a reference frame within the ID software. Hence, failure to locate the border results in an ID reject and further ID processing is terminated.

[3] Similarly shaped characters are often misinterpreted (e.g., 1, i, and I can be confused) by the recognition engine. Such characters are termed "confusion classes" and have to be accounted for in the interpretation process.

The results are summarized in the tables 2 through 4. Detailed results can be found in Appendix A.

Table 2. IBM Results

Total number of images	71
Total number of images accepted by CADA	23
Total number of images rejected by CADA	48
Total number of images accepted by visual inspection	63
Total number of images rejected by visual inspection	8
Total number of images falsely accepted by CADA	0
Total number of images falsely rejected by CADA	40
Percentage of total images falsely accepted by CADA	0
Percentage of total images falsely rejected by CADA	56.3

Table 3. Hughes Results

Total number of images	217
Total number of images accepted by CADA	68
Total number of images rejected by CADA	149
Total number of images accepted by visual inspection	141
Total number of images rejected by visual inspection	76
Total number of images falsely accepted by CADA	5
Total number of images falsely rejected by CADA	78
Percentage of total images falsely accepted by CADA	2.3
Percentage of total images falsely rejected by CADA	35.9

Table 4. Magnavox Results

Total number of images	228
Total number of images accepted by CADA	195
Total number of images rejected by CADA	33
Total number of images accepted by visual inspection	220
Total number of images rejected by visual inspection	8
Total number of images falsely accepted by CADA	2
Total number of images falsely rejected by CADA	27
Percentage of total images falsely accepted by CADA	0.87
Percentage of total images falsely rejected by CADA	11.8

The high percentage of false rejects in the case of IBM and Hughes data is due to the fact that the data in those sets consists mainly of technical illustrations and not engineering drawings. CADA techniques work best with engineering drawings conforming to ANSI standards for formats and line widths.

4.3.2 ID recognition analysis

Magnavox contractor data images which passed image analysis were input to the ID recognition portion of CADA. The results of this analysis will be used as a feedback to improve various components of ID recognition. The results are listed in Table 5.

Table 5. ID Recognition Analysis Results

Total images	Image rejects	Assoc. list	ID success	ID error
228	44	12	42	130

As shown in Table 5, 44 of the total 228 images were rejected by the image analysis software. Among the images which passed image analysis, 12 were found to be associated lists. These images are not considered because the current ID software operates only on engineering drawing images. As a result, 172 valid engineering drawings were input into the ID recognition software.

Of these 172 images, 42 were ID classification successes (they were either correctly accepted or correctly rejected based on the criteria outlined in section 4.2). It should be noted that there were no false accepts among the 130 ID errors, as shown in Table 6.

Table 6. Breakup of ID Errors

Total ID errors	False rejects	False accepts
130	130	0

The ID errors were then divided among the following sub-components: pre-processing, recognition engine, and post-processing. These results are listed in Table 7.

The pre-processing is further categorized into errors occurring due to three different reasons: border location, broken characters in the key id text data, and string segmentation.

Table 7. ID Errors by Causes

Pre-processing			Recognition	Post-processing
Border	Broken Chars	String Segment		
4	18	19	83	105

It should be noted that the total number of errors in different categories add up to well over 130. This is due to the fact that in a single image, multiple errors may occur and these are counted separately.

Most of the post-processing errors occur in interpreting the sheet number. Often the sheet number is far away from its label and the current criteria are very strict in qualifying it to be the sheet number data. Efforts are under way to make these criteria more flexible in order to accommodate these variations and thus improve the acceptance performance.

The errors in recognition occur mainly due to the characters touching each other or the lines of the enclosing box. The reasons can be attributed to scanning problems as well as fat strokes in the characters. These failures cannot be helped in the short term. Some line thinning or skeletonization algorithms may need to employed as part of the pre-processing on these characters. This or similar efforts are being researched for improved pre-processing performance.

The border location errors in the pre-processing are mainly due to the resolution of the algorithm. Any further increase in the resolution will lead to increased time in the calculations. Some character fusing algorithms may need to be researched in order to combat the problem of broken characters. The string segmentation problem can be tackled by improved string forming algorithms in pre-processing.

5 CONCLUSIONS

5.1 Image Analysis

1. The current CADA techniques work best on engineering drawings conforming to ANSI standards. They do not work well on technical illustrations and text data. Additional techniques should be incorporated in the future to improve the results on this type of data.

2. So far, the CADA techniques work uniformly on all images, irrespective of their type, size, or other characteristics. An automated tuning of parameters based on the type, size, or other characteristics of images can possibly improve CADA results.

3. CADA techniques are designed to detect general flaws like presence of noise, fading, discontinuities, etc. and cannot detect specific flaws based on any interpretation of the contents. In the field, CADA can be most useful if the acceptance criteria are clearly defined in general, objective terms and not on any subjectiveness or interpretation of contents.

4. The Magnavox data provides the most representative range of data among the three sets tests and should be tested further with CECOM DSREDS locally.

5.2 ID Analysis

Most of the post-processing errors occur in sheet number interpretation. Often the distance between the sheet label and data exceeds the current constraints in the software. Efforts are underway to make these criteria more flexible in order to accommodate these variations and thus improve the acceptance performance.

The errors in recognition occur mainly due to touching characters in the raster image. These characters not only touch each other, but often overlap the enclosing box. The reason for this problem is attributed to scanning problems as well as thick strokes in the characters. No short term solutions exist for these problems. A long term effort involving algorithm analysis for line thinning or skeletonization may be required.

The border location errors in the pre-processing section are due to the resolution of the algorithm. Any further increase in the resolution will lead to increased time in the calculations. Some character fusing algorithms may be necessary to combat the problem of broken characters. The string segmentation problem may be tackled by improved criteria in string merging algorithms.

6 RECOMMENDATIONS

6.1 Image Analysis

1. Further analysis should be conducted to establish a correlation between different types of images and CADA parameter settings. For certain types, new techniques such as blob analysis should be explored.

2. Further testing should be done in collaboration with QA inspectors from the field to establish objective, general criteria for acceptance and tune CADA algorithms to match those criteria.

3. Pursue testing of the Magnavox data with CECOM DSREDS locally in accordance with the Test Plan included in Appendix B, and prepare a test report containing the results.

6.2 ID Analysis

1. The following specific needs for improvement in the subcomponents of the ID software emerged during the contractor data tests:

   a) sheet label-data: further enhancements to allow for large distances;
   b) string segmentation: connected component grouping criteria requires refinement;
   c) line thinning algorithms: required for addressing problems of touching characters; and
   d) border location: requires increased resolution.

2. More contractor data is required to further test and improve the ID recognition algorithms. Feedback from field QA operators is also required to assist with future modifications and tuning.

APPENDIX A

CADA TEST RESULTS

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

**************** CONTRACTOR DATA - MAGNAVOX ****************											
FILE	<------ CADA RESULTS ------>			MAN QA	<------------------ I. D. RESULTS ------------------>						
Parameters	High Q	Medium Q	Low Q	Visual QA	R1	R2	R3	R4	R 5		
D001R001	R	R	R	R							
D001R002	R	R	A	A					X		
D001R003	R	R	R	A							
D001R004	R	A	A	A				X	X		
D001R005	A	A	A	A							
D001R006	R	R	A	A							
D001R007	R	A	A	A					X		
D002R001	A	A	A	A							
D003R001	A	A	A	A							
D004R001	A	A	A	A							
D005R001	A	A	A	A							
D006R001	A	A	A	A							
D007R001	A	A	A	A							
D008R001	A	A	A	A							
D009R001	R	A	A	A							
D009R002	A	A	A	A							
D010R001	A	A	A	A							
D010R002	A	A	A	A							
D011R001	A	A	A	A							
D011R002	A	A	A	A							
D011R003	A	A	A	A							
D011R004	A	A	A	A							
D011R005	A	A	A	A							
D011R006	A	A	A	A							
D012R001	A	A	A	A							
D012R002	A	A	A	A				X			
D012R003	A	A	A	A		X					
D013R001	A	A	A	A							
D013R002	A	A	A	A							
D013R003	A	A	A	A	X						
D013R004	A	A	A	A							

D013R005	A	A	A	A							
D014R001	R	R	A	A			X	X			
D014R002	R	A	A	A				X	X		
D014R003	A	A	A	A				X	X		
D014R004	A	A	A	A				X	X		
D015R001	A	A	A	A			X	X	X		
D015R002	R	A	A	A				X	X		
D015R003	R	A	A	A				X	X		
D015R004	A	A	A	A					X		
D015R005	A	A	A	A			X				
D015R006	A	A	A	A					X		
D016R001	R	R	R	R			X	X			
D016R002	R	R	A	A				X	X		
D016R003	A	A	A	A				X	X		
D016R004	A	R	A	A				X	X		
D017R001	R	R	R	A							
D017R002	A	A	A	A				X	X		
D017R003	R	R	A	A					X		
D017R004	R	R	R	A							
D017R005	R	R	A	A					X		
D017R006	R	A	A	R		X			X		
D017R007	R	R	A	A					X		
D017R008	R	A	A	A				X	X		
D017R009	R	R	R	R							
D017R010	R	R	R	R							
D017R011	A	A	A	A		X			X		
D017R012	A	A	A	A		X			X		
D017R013	R	R	A	A		X			X		
D018R001	R	A	A	A							
D018R002	A	A	A	A			X				
D018R003	R	A	A	A			X		X		
D018R004	R	A	A	R			X		X		
D018R005	A	A	A	A			X				
D018R006	R	R	R	A							
D018R007	R	R	R	A							

D018R008	R	R	R	R							
D018R009	A	A	A	A		X		X	X		
D018R010	R	R	R	A							
D018R011	R	A	A	A		X			X		
D018R012	A	A	A	A				X	X		
D018R013	R	R	R	R							
D018R014	R	A	A	A					X		
D018R015	R	R	A	A		X			X		
D018R016	A	A	A	A				X	X		
D019R001	R	R	R	R							
D019R002	R	R	R	A							
D019R003	R	A	A	A				X	X		
D019R004	R	A	A	A				X	X		
D019R005	A	A	A	A					X		
D019R006	R	R	R	A							
D019R007	R	A	A	A							
D019R008	R	A	A	A				X	X		
D019R009	R	A	A	A				X	X		
D020R001	A	A	A	R				X	X		
D020R002	R	R	A	A							
D020R003	R	A	A	A				X	X		
D020R004	R	A	A	A				X	X		
D020R005	A	A	A	A				X	X		
D020R006	R	R	R	A							
D020R007	R	R	R	A							
D020R008	A	A	A	A				X	X		
D020R009	R	A	A	A							
D020R010	R	A	A	A					X		
D021R001	A	A	A	A				X	X		
D021R002	R	R	R	A							
D021R003	R	A	A	A				X	X		
D021R004	R	R	A	A				X	X		
D021R005	R	A	A	A							
D021R006	R	R	R	A							
D021R007	R	R	R	A							

D021R008	R	A	A	A		X					
D022R001	R	A	A	A			X				
D022R002	R	R	A	A							
D022R003	R	R	A	A							
D022R004	R	R	A	A							
D022R005	A	A	A	A							
D022R006	A	A	A	A		X					
D022R007	A	A	A	A							
D022R008	A	A	A	A							
D022R009	A	A	A	A							
D023R001	R	R	A	A			X	X	X		
D023R002	R	A	A	A					X		
D023R003	R	A	A	A		X			X		
D024R001	R	R	R	A							
D024R002	R	A	A	A					X		
D024R003	A	A	A	A					X		
D024R004	A	A	A	A					X		
D024R005	A	A	A	A					X		
D024R006	A	A	A	A				X	X		
D024R007	A	A	A	A				X	X		
D025R001	A	A	A	A		X	X		X		
D025R002	R	R	A	A					X		
D025R003	A	A	A	A					X		
D025R004	R	R	A	A							
D025R005	A	A	A	A				X	X		
D025R006	R	R	A	A							
D026R001	R	A	A	A		X		X	X		
D026R002	R	R	A	A							
D026R003	A	A	A	A							
D026R004	A	A	A	A					X		
D026R005	A	A	A	A				X	X		
D027R001	R	R	A	A			X	X			
D027R002	R	R	R	R							
D027R003	R	A	A	A				X	X		
D027R004	R	R	A	A							

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

D028R001	A	A	A	A	X						
D028R002	A	A	A	A				X			
D028R003	A	A	A	A		X					
D028R004	A	A	A	A				X	X		
D028R005	A	A	A	A				X	X		
D028R006	A	A	A	A		X		X	X		
D028R007	A	A	A	A				X	X		
D028R008	A	A	A	A				X	X		
D028R009	A	A	A	A		X		X	X		
D028R010	A	A	A	A				X	X		
D028R011	A	A	A	A				X	X		
D028R012	A	A	A	A				X	X		
D028R013	A	A	A	A		X		X	X		
D028R014	A	A	A	A				X	X		
D028R015	A	A	A	A		X		X	X		
D028R016	A	A	A	A							
D028R017	A	A	A	A				X	X		
D028R018	A	A	A	A				X	X		
D029R001	R	R	A	A							
D029R002	R	R	R	A							
D029R003	R	R	R	A							
D029R004	R	R	R	A							
D029R005	R	R	A	A							
D029R006	A	A	A	A				X	X		
D029R007	R	A	A	A							
D030R001	R	R	R	A							
D030R002	R	R	A	A					X		
D030R003	R	R	R	A							
D030R004	R	R	R	A							
D030R005	R	R	A	A					X		
D030R006	R	A	A	A		X			X		
D030R007	A	A	A	A				X	X		
D031R001	A	A	A	A	X						
D032R001	A	A	A	A			X				
D033R001	R	A	A	A				X	X		

D033R002	R	A	A	A				X	X		
D033R003	R	R	R	A							
D033R004	R	R	A	A							
D033R005	A	A	A	A				X	X		
D033R006	R	R	R	A							
D034R001	R	R	A	A			X	X			
D034R002	R	A	A	A				X	X		
D034R003	R	R	A	A							
D035R001	R	R	A	A			X	X			
D035R002	R	R	A	A							
D035R003	R	R	R	A							
D035R004	R	R	R	A							
D035R005	A	A	A	A				X	X		
D035R006	R	R	A	A							
D036R001	R	A	A	A			X	X			
D036R002	R	R	R	A							
D036R003	R	R	A	A							
D036R004	R	R	A	A							
D036R005	R	R	A	A							
D036R006	R	R	A	A							
D037R001	R	A	A	A			X		X		
D037R002	R	R	A	A							
D037R003	R	R	A	A				X	X		
D037R004	R	R	A	A							
D037R005	R	R	A	A							
D037R006	R	R	A	A					X		
D037R007	A	A	A	A				X	X		
D037R008	R	R	A	A					X		
D038R001	R	R	A	A			X	X	X		
D038R002	R	R	A	A							
D038R003	R	A	A	A							
D039R001	A	A	A	A				X	X		
D039R002	R	R	A	A							
D039R003	R	R	R	A							
D040R001	R	A	A	A			X	X			

Computer-Assisted Data Acceptance (CADA) Contractor Test Report

D040R002	R	A	A	A					X		
D040R003	R	A	A	A				X	X		
D041R001	A	A	A	A	X						
D042R001	A	A	A	A							
D043R001	R	A	A	A			X				
D043R002	R	R	A	A				X	X		
D043R003	R	R	R	A							
D043R004	R	R	A	A				X	X		
D043R005	R	R	A	A				X	X		
D043R006	R	A	A	A				X	X		
D043R007	R	R	A	A				X			
D043R008	A	A	A	A			X	X			
D044R001	A	A	A	A			X	X	X		
D044R002	R	A	A	A				X	X		
D044R003	R	A	A	A				X	X		
D044R004	A	A	A	A				X	X		
D045R001	A	A	A	A			X				
D046R001	A	A	A	A							
D047R001	A	A	A	A							
D048R001	A	A	A	A							
D049R001	A	A	A	A							
D050R001	A	A	A	A							
					Note:						
					R1 =	Pre-Processing: Border Location					
					R2 =	Pre-Processing: Broken Characters					
					R3 =	Pre - Processing : String Segmentation					
					R4 =	Recognition Engine					
					R5 =	Sheet label-data distance error					

APPENDIX B

CTC TEST PLAN
CALS Contractor Data Acceptance Tests
17 November 1990

1. Introduction and Background

The Project Manager, Joint Computer-aided Acquisition and Logistic Support (PM JCALS) has developed, under the direction of the CALS Test Network Office (CTNO), Computer-Assisted Data Acceptance / Quality Assurance (CADA/QA) tools and procedures that will automate the acceptance of CALS formatted raster type 1 digital data. Integration of the CADA tools has been completed and operational field testing of the tools with contractor furnished data is scheduled to commence in early 1993. In preparation for the field tests, contractor data in CALS format will be tested within the PM JCALS CALS Technology Center (CTC).

2. Objective

The objective of the laboratory testing of CALS contractor data is to test the tools with different parameters in order to obtain the best QA performance on "live" data. In order to achieve this objective, the Communication Electronics Command (CECOM), Concurrent Engineering Directorate (CED) and CECOM Digital Storage and Retrieval Engineering Data System (DSREDS) personnel have agreed to provide CALS contractor data and participate in the testing effort.

3. Standards and Specifications

3.1 MIL-STD-1840A

3.2 MIL-R-28002A

4. Procedures

The testing of CALS contractor data is a cooperative effort between the ARMY CECOM Concurrent Engineering Directorate (CED), CECOM DSREDS and PM JCALS personnel. The CED will obtain the contractor data on a CALS formatted Magnetic Tape and provide it to PM JCALS who will load the data and return the Magnetic Tape to CED. CED personnel will give the Magnetic Tape to CECOM DSREDS personnel who will load the data and manually inspect all of the images on the DSREDS system. PM JCALS will evaluate the contractor data with the CADA tools and compare the results with the results obtained from DSREDS. The CADA parameters will then be changed to more closely match the results obtained from DSREDS. The following scenario will be followed closely in order to meet the

December delivery date.

4.1 Concurrent Engineering Directorate (CED) Participation

1. Provide comments and inputs to PM JCALS in preparation of the test plan.
2. Obtain the magnetic tape from the contractor.
3. Deliver the magnetic tape to the CTC for format verification and tape duplication.
4. After format verification, obtain the original magnetic tape from the CTC and deliver to the DSREDS personnel.
5. Participate in the review of the CTC and DSREDS testing effort.
6. Review the draft PM JCALS test report and submit comments.
7. Obtain a copy of the PM JCALS final test report.

4.2 PM JCALS CTC Participation

1. Prepare the "draft" test plan.
2. Obtain inputs and assistance in preparing the final test plan from the CED and DSREDS personnel.
3. Obtain magnetic tape from the CED, load image data, validate MIL-STD-1840 format, prepare a data list and return the magnetic tape and a data list to CED.
4. Perform the CADA testing. Record the performance times to load, evaluate, inspect and print the results.
5. Obtain the inspection results from DSREDS.
6. Analyze the compared results, modify CADA parameters accordingly, and repeat the CADA tests. Record the results and again compare with DSREDS manual inspection results. Repeat the CADA tests with new CADA parameters, as required, to obtain the results that best agree with the DSREDS QA analysis within the time schedule defined in Section 6.
7. Prepare a draft test report and review the results with CED and DSREDS personnel.
8. Finalize the test report and submit to PM JCALS/CTNO.

4.3 CECOM DSREDS Participation

1. Provide comments and inputs to PM JCALS in preparation of the test plan.
2. Obtain the contractor magnetic tape from CED.
3. Load the magnetic tape onto an Intergraph workstation to validate the MIL-STD -1840 format and convert the CALS data to the DSREDS format. Record the loading and validation elapsed times.
4. Perform 100% inspection of the image and identification data using the DSREDS QA workstation and existing QA procedures. Record the time to accept or reject the image and identification data for accuracy as well as the total elapsed time to perform the manual loading, conversion and inspection processes.
5. Submit the results to PM JCALS for CADA test results comparisons and input to

the test report.
6. Review the draft test report from PM JCALS and submit comments.
7. Obtain a copy of the PM JCALS final test report.

5. Facilities and Equipment

1. PM JCALS CTC Sun and/or PC Workstation and CADA tools.
2. CECOM DSREDS facilities and equipment required to perform conversion and inspection of CALS data submitted on magnetic tape media.

6. Schedule

1. The CED delivers Contractor data on MIL-STD-1840 formatted Magnetic Tape media to PM JCALS. - Week of November 16, 1992.
2. PM JCALS validates magnetic tape format and duplicates tape. November 20, 1992 or 2 working days after receipt of the magnetic tape from the CED.
3. The CED delivers the Magnetic Tape, with a PM JCALS prepared Data List to CECOM DSREDS one working day after receipt from the PM JCALS CTC (Goal November 24 1992).
4. PM JCALS completes the first CADA QA Acceptance tests within one week after receipt of the magnetic tape (No later than December 1, 1992).
5. CECOM DSREDS completes 100% manual QA within __ week(s) after receipt of the magnetic tape - No later than December 7, 1992.
6. PM JCALS modifies the CADA parameters, repeats the CADA tests, documents results in a draft test report and review the results with CED and DSREDS personnel. (By December 14, 1992.)
7. PM JCALS prepares a final internal test report by December 16, 1992.
8. PM JCALS management receives the final test report by December 21, 1992.

7. Participants

1. PM JCALS
2. Army CECOM CED
3. Army CECOM DSREDS
4. ACCURATE Information Systems, Inc.